STANDARD OPERATING PROCEDURE NO. 10

BATHYMETRIC SURVEYING

2.0 TABLE OF CONTENTS

3.0 PURPOSE AND SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for conducting a bathymetric survey as part of the Newark Bay Study Area Remedial Investigation Work Plan (RIWP). This SOP provides descriptions of equipment, field procedures, and documentation necessary to conduct the survey. The objectives and locations of the bathymetric survey are discussed in the IWP.

This SOP may change depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP shall be approved in advance by the Facility Coordinator (FC) (or Alternate FC), and United States Environmental Protection Agency (USEPA) Remedial Project Manager. The ultimate procedure employed will be documented in the Newark Bay RI Report.

Other SOPs will be utilized in conjunction with this SOP, including:

- SOP No. 1 – Field Documentation;
- SOP No. 3 – Decontamination; and
- SOP No. 4 – Tide Gage Installation.

4.0 PROCEDURES

4.1 EQUIPMENT LIST

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by RIWP Volume 3 (Tierra, 2005);
- survey vessel adequate for Newark Bay conditions;
- fathometer with a resolution of 0.1 foot;
- Differential Global Positioning System (DGPS) including a base station and a rover receiver and external antenna;
- calibration plate;
- navigation, plotting, and computer equipment;
- logbook and location map; and
- surveying equipment.

4.2 PROCEDURE

Bathymetric soundings will be collected at approximate 0.25-mile intervals along sounding lines throughout the Phase I Sediment Investigation (SI) Study Area. More closely-spaced, shorter tracklines may also be positioned around shoreline structures, bridge crossings, and sharp grade breaks in the navigation channel banks, as necessary. Survey lines will be pre-plotted prior to commencement of the survey.

One tide gage will be installed within Newark Bay prior to surveying. The gage will be installed according to SOP No. 4 – Tide Gage Installation.

Bathymetry measurements in the shallow, sub-tidal flats will be collected during high-water periods, if boat draft limitations are anticipated. High-water periods will be classified as the period ranging from 2 hours prior to the predicted high tide until 2 hours after the predicted high tide. Conducting the survey during high-water periods will allow measurements to be taken over the shallow, Sub-tidal Flats of Newark Bay, as well as the deeper sections. Bathymetry measurements in the deeper Northern and Southern Navigation Channels and Transitional Slopes may also be performed during low tide. The tide level will be recorded as described in Section 4.3 (below) during the time period the measurements are made.

A DGPS base station will be established over a shore-based marker (USACE monument or temporary benchmark) prior to survey operations. DGPS corrections transmitted to the survey vessel from the base station will allow for the collection of real-time, precision water level data at the survey vessel during bathymetric data collection. The operation and horizontal/vertical accuracy of the vessel mounted DGPS will be verified at another USACE monument or temporary benchmark by recording observed horizontal and vertical (XYZ) data and comparing these data to the known position for that point.

Calibration checks of the fathometer will occur a minimum of twice each day – once before work commences and once after completing the day's activity.

Each survey line recording will be labeled with the survey line number, direction of travel, date, time, and the name of the fathometer operator.

Upon completion of field activities, the profiles will be adjusted using tide data so that depth data are reported relative to the North American Vertical Datum of 1988 (NAVD88).

4.3 BATHYMETRIC SURVEY - GENERAL SPECIFICATIONS

The accuracy of the bathymetry survey will meet or exceed the USACE Class 1 Hydrographic Survey Standard (USACE Hydrographic Surveying Engineer Manual EM 1110-2-1003 dated January 2002). The following are general specifications for the bathymetric survey:

1. Survey Vessel - Adequate for Newark Bay conditions and capable of supporting and operating the bathymetric positioning and sampling equipment.

2. Vessel Positioning - Horizontal positioning system capable of at least $\pm$1 foot accuracy.

3. Vessel Navigation - Navigation system made up of computer-based software providing: display of vessel position relative to intended survey lines (with right/left helmsman indicator); navigation channel limits; aids to navigation; shoreline; and other features. Computer and software (such as Hypack®) will be capable of displaying the cross-section data as acquired (i.e., real-time basis) for the purpose of QA/QC and to log both vessel position and digital depth data.

4. Soundings - Fathometer should be capable of dual-frequency sounding (e.g., 28 and 200 kHz), with a resolution of 0.1 foot. Soundings will be logged at approximately 0.1-second time intervals or at about 2-foot distance intervals along each survey line. The fathometer will be calibrated for water mass sound speed using standard bar check procedures.

Horizontal control for the project will be established from USACE monuments located along the banks of Newark Bay.

Vertical control points will also be obtained from the USACE along with their staging data for tides in Newark Bay. Vertical control information will be shown on drawings and charts produced.

Despite virtually worldwide, 24-hour coverage, technical difficulties with GPS satellites can still occur. In the event of system-wide or other long-term problems with GPS (e.g., satellite failures), survey vessel positioning will be achieved using land-based methods. If a land-based method is selected, an SOP will be developed for its use.

4.4 DECONTAMINATION

Survey and sounding equipment which has been immersed in Newark Bay waters will be decontaminated in accordance with SOP No. 3 - Decontamination.

5.0 QUALITY ASSURANCE

The fathometer and DGPS receivers will be operated and maintained in accordance with the manufacturer's operating manuals. Field instruments will be used by experienced operators familiar with field procedures and manufacturer's instructions.

The vessel-mounted DGPS system performance will be verified daily prior to and after survey activities using a temporary survey point. Vessel position during the bathymetry survey will be checked using computer software (such as Hypack®).

6.0 DOCUMENTATION

The documentation requirements for the field personnel will include recording observations made during profiling that could affect the quality of the data. Complete field documentation procedures are presented in SOP No. 1 – Field Documentation.

In addition, the following information will be recorded in a logbook (at a minimum):

- Survey line number;
- Direction of travel;
- Date;
- Time (EST);
- Time of high tide (EST);
- Profiling equipment (e.g., name and serial number);
- Equipment calibration information;
- Unusual conditions;
- Brief description of the area around the survey line location and the weather conditions at the time of profiling; and
- Description of transect beginning and end-points.

7.0 REFERENCES

Tierra. 2005. Newark Bay Study Area Remedial Investigation Work Plan. Volume 3 Health and Safety/Contingency Plan. September.